Winter 12-4-2017

Industrie 4.0 and Leadership

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Prince, K.A. (2017). Industrie 4.0 and leadership. In *Proceedings of The 17th International Conference on Electronic Business* (pp. 132-139). ICEB, Dubai, UAE, December 4-8.

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ABSTRACT

Industrie 4.0 focuses on end-to-end digital transformation with digital ecosystems. Digital transformation and industrie 4.0 are more efficient and effective with particular skills, knowledge and attitude. Leaders who practice leadership 4.0 are digital leaders and digital transformers. This digital leadership framework is based on a transformational, transactional, and authentic leadership matrix. This trichotomous leadership model is based on Adaptive Structuration Theory (AST) which applies the impact of Advanced Information Technology with leadership in a recursive relationship with each affecting and transforming the other.

Keywords: authentic, transformational, transactional, digital leadership, digital age

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INTRODUCTION

The technology revolution and how a company digitizes itself influences business results (Khan, 2016). This is digital disruption and requires transformational change which this research and others call digital transformation (Westerman *et al.*, 2011). This digital transformation global megatrend is changing existing value chains across industries, corporations, and public sectors (Khan, 2016); and demands convergence of roles in a flatter more collaborative environment (Campbell, 2012).

Digital disruption and digital transformation are associated with Industrie 4.0 (Bunse, 2013). Industrie 4.0 refers to the fourth industrial revolution which is grounded in technological evolution from cyber physical systems to embedded systems to the Internet of Things (IoT) (Bunse, 2013). Information and communication technologies (ICT) are the foundation that innovative solutions build on; and are made possible through technological advances (Bunse, 2013).

Industrie 4.0 is radically transforming industry, business models, and production value chains through smart production processes and embedded system production technologies (Bunse, 2013). In simple terms, technological advances include a reversal of conventional product process logic whereby the product communicates with the machinery to tell it what to do (Bunse, 2013).

Industrie 4.0 requires digital reinvention, such that corporation's need to pursue new strategic focus, establish new ways of working and develop new expertise (Berman, Korsten & Marshall, 2016; HBR Analytic Service, 2015). Digital reinvention of the corporation through driving digital transformation requires consideration of the corporation and larger society as digital ecosystems (Eng Chew, 2013; Khan, 2016). Digital ecosystems include disruptive business models, fundamental change, and platforms that integrate end customers, and digital natives (Nally, 2016). Furthermore, gains in efficiency have the potential to transform today's competitive environment quickly; using cloud based planning platforms (Nally, 2016).

Rogers (2016) points that digital transformation is a big task for corporations to achieve. Therefore digital transformation also requires consideration of leading the digital transformation (Khan, 2016). The leadership literature however, rarely considers digital transformation; it's like a gap exists between digital transformation and contemporary leadership practice (Khan, 2016).

Many leadership scholars practice their art without considering digital transformation, however the intersection of these areas is interesting (Bass & Riggio, 2006; Walumbwa *et al.*, 2008). Khan (2016) found six digital transformational competencies in three forms of contemporary leadership styles; values-based, transformational and authentic leadership styles. This research argues an overlap between all three leadership styles is warranted for digital age leadership.

Research indicates that digital age corporate leaders need to be flexible in today's rapidly changing digital world (HBR Analytic Service, 2015; Nally, 2016). Leadership today requires the exercise of influence rather than excessive force and power (Bolden & O'Regan, 2016). Corporate leaders, especially the CEO, CTO, CDO and CIO define and lead the digital transformation heavily relying on core competencies like data analytics to enhance corporate structures (Nally, 2016).

An interview with Mastercard Chairman, Rick Haythornthwaite Nally (2016) reveals his thoughts and feelings about today's leadership and the digital environment (Bolden & O'Regan, 2016). Nally (2016) argues that technology sources and making the most of data, to drive down the production development cycle and adoption costs is necessary for digital transformation (Bolden & O'Regan, 2016). Digital transformation is turning our world into a virtual one changing many facets of our understanding of life and the world we live in; being generally disruptive and turning our lives upside down (Bolden & O'Regan, 2016).

Leadership rules however, are currently being rewritten for the first time ever; no longer are charismatic, omniscient and omnipotent leaders useful; a leader must know how and when to lead, support, coach, facilitate, and influence others (Bolden & O'Regan, 2016). Social activists and entrepreneurs are using powerful digital tools and accesses are setting today's digital transformational agenda (Bolden & O'Regan, 2016).

Digital transformation fundamentally changes value chains across industries and public sectors to develop new digital ecosystems (Khan, 2016). These digital ecosystems are known for mobile apps, machine to machine, big data, industrial internal, internet of things, and industrie 4.0.

INDUSTRIE 4.0

The fourth industrial revolution is about using cyber-physical systems in the manufacturing process and as such is called Industrie 4.0 (Bunse, 2013; Raza, 2016). Industrie 4.0 digital transformation is well underway in Germany, who are international leaders in embedded systems and digital technology (Bunse, 2013). Using and understanding digital technology is rapidly become a core competency with success largely depending on the corporations' overall digital ecosystem (PwC network, 2016).

Digital ecosystems with value chain partners rely on a wide range of new technologies to communicate data that underpins gains promised by Industrie 4.0 (Nally, 2016). Industrie 4.0 focuses on end-to-end digital transformation with digital ecosystems relying on trust in data security, communication systems, and intellectual property for integrity and security (Dennis Nally, 2016).

End-to-end digital transformation is driven by focusing on people and culture, with the biggest challenge attracting the digital generation and others comfortable with working in a digital ecosystem (PwC network, 2016). Digital ecosystems expand and with it the importance of trust, transparency, and the integrity of third party data (Nally, 2016). Data analytics drive decision making with robust corporate structures supporting data analytics as an enterprise level digital capability (PwC network, 2016). Digital capabilities are important to move forward with Industrie 4.0 with (PwC network, 2016) suggesting a six step model for digital success. These steps are; mapping strategy, creating pilot projects, defining capabilities, expertise in data analytics, digital transformation, and planning an ecosystem approach (Nally, 2016). The reality of Industrie 4.0 however, is that change is transcending corporate boundaries and also national boundaries of where people do business, faster than corporations can keep up the pace (PwC network, 2016).

When digital capabilities are embed functionally in the corporation (Nally, 2016); then organising data analytics develops cross-functional expert teams (PwC network, 2016). This improves services and products where strategy and operations meet creating disruption (Nally, 2016). Consequently, disruptive business occurs with customers competing for services and products thus creating a digital culture (Nally, 2016). A digital culture aligns the digital generation with other generations; consequently all are thinking and acting like the digital generation, ready and willing to experience new technologies and new ways of operating (PwC network, 2016).

A systematic step-by-step approach to Industrie 4.0 digital capabilities starts with prioritising measures, aligning overall strategy, and jumping into it head first; by setting clear targets and prioritising measures (PwC network, 2016). Accurate measures can tell a lot about the business, providing clarity and direction (PwC network, 2016). Measuring leadership statistics and technopreurnial capability is David and goliath stuff of mass proportions (PwC network, 2016).

First movers however, are making investments in Industrie 4.0 and realising above average digital revenues and operational savings with digital services and products developing disruptive business models (PwC network, 2016). Disruptive business models are improving both top and bottom line simultaneously with Industrie 4.0 reshaping competitive digital ecosystems. Customer-centric value chains, services, and products are to be commonplace with corporations having to own relationships with end customers (PwC network, 2016).

Industrie 4.0 is spanning the globe creating digital networks and digital ecosystems, however distinct regional footprints are to be retained (PwC network, 2016). Countries such as Germany and Japan collaborate along the horizontal value chain with high investments in technology and employee training view their digital transformation in terms of cost reduction, operational efficiency, and quality assurance (PwC network, 2016). China's standout aspects of digital transformation are in digitising and automating labour intensive manufacturing (PwC network, 2016). While the US suggest they are planning to develop disruptive business models through digitising service portfolios and products (PwC network, 2016).

Industrie 4.0 frameworks include data and analytics as core capabilities connecting such technologies as (but not limited to) Smart Sensors, Cloud Computing, Mobile Devices, loT Platforms, 3D Printing, Location Detection, Cyber-Physical Systems, etc (Nally, 2016). Industrie 4.0 leads tomorrow's digital ecosystems to focus on people and culture to drive digital transformation and deepen digital relationships with empowered customers (PwC network, 2016). Industrie 4.0 promises a complete view of digital networks with digital transformation driven by an integration of vertical and horizontal value chains, and disruptive digital business models, (PwC network, 2016).

Industrie 4.0 is reshaping the competition of established industries paving the way for disruptive business models and disruptions to industry, like Uber's disruption to the taxi industry and Air B'n'B to the hotel industry (PwC network, 2016). PwC network (2016) surveyed 2,000+ corporates, and found 70% expect to dramatically increase their level of digital transformation by 2020 and only 33% rating their corporate as digitally advanced today. Global digital transformation processes however require a digital IQ far exceeding the current change process (Nally, 2016).

Digital IQ is important for the success of digital investments (PwC network, 2016). Digital IQ focuses on the broad range of people factors involved with the success of implementing the right digital technologies (Brown *et al.*, 2013). This is important for the C suite developing a robust digital culture and attracting and retaining the right employees who should be comfortable working in a dynamic digital ecosystem environment (PwC network, 2016).

LEADERSHIP 4.0

Industrie 4.0 is more efficient and effective with particular skills, knowledge, and attitude leading it (Raza, 2016). Raza (2016) argues that these particular leadership skills are about innovation and driving results; this is conceptualised as Leadership 4.0. Leadership 4.0 is based on the premise that leaders see the future, explore the future, and return to train others (Raza, 2016).

The German Chancellor Angela Markel arguably practices Leadership 4.0 emphasizing that Germany takes a lead in Industrie 4.0 by raising importance to industrial production, logistics, and by connecting to digital technologies (Raza, 2016). Raza (2016) concludes that success in tomorrow's industrial 4.0 environment requires different characteristics, approaches and practices than traditional leadership can offer. However Raza (2016) defines leadership 4.0 as the adaptability to fit, innovate, and survive the Industrie 4.0 ecosystems (Raza, 2016).

Leadership 4.0 is further defined as the hierarchy based on functional units with the key driver of efficiency of divisional labour (Raza, 2016). Best divisions of labour are developed through organization of mass markets of divisional organizational mode and computing and information enable organisation of globalization by using tools like SAP, which need matrix organization (Raza, 2016). A combination of several innovations in digital technology developed the Leadership 4.0 terminology (Raza, 2016). Leadership 4.0 is synonymous with talent acquisition and development, and communications, whereby everyone is innovative (Raza, 2016).

Leaders who practice leadership 4.0 are digital leaders and digital transformers (Raza, 2016). Digital transformation includes a number of technologies such as data storage, digital technology, cloud computing, internet of things, digital 3D printing, mobile devices, satellite, smart cars, and algorithms to direct motor vehicles (Raza, 2016). These digital technologies when joined together integrate the virtual and physical world into a highly networked digital ecosystem with cyber-physical systems (Raza, 2016).

Based on the details and challenges of Industrie 4.0 it is required that industry leaders be equipped with skills and traits to be tomorrow's leaders (Raza, 2016). The transition from Leadership 3.0 to Leadership 4.0 is arguably comprised of four leadership capabilities; digital vision, converting the vision into action, unit of effort re-design and transformation governance (Raza, 2016). These are elaborated as follows;

i. Digital vision, when the leader 4.0 creates a transformational vision then the digital transformation journey begins to align senior managers and staff around the vision (Raza, 2016);
ii. Converting the vision into action, when the leader 4.0 decides to move forward the vision becomes a reality formulating a road map of initiative including entry point of pilot project (Raza, 2016);
iii. Unit of effort re-designing the knowledge or jobs to be complete with the global talent tool and initiating with pilot projects to achieve the efficiency of performance to market like increasing zero marginal expenses (Raza, 2016); and
iv. Transformational governance is critical to transform using a rudder to steer the digital initiatives in the required direction to ensure sustainability of the transformation process (Raza, 2016).

Traditionally most Leadership approaches use a three factor taxonomy of skills; however the challenge of Industrie 4.0 demonstrates a need for a different skill set (Raza, 2016). Such as vertically & horizontally focused (Initiative) or technical skills, Individual ownership of development (Accountability), collective leadership (Collaboration) or interpersonal skills, and innovation (Critical Thinking) (Raza, 2016).

When corporations have high digital competencies in leadership they can meet today's and tomorrow's challenges (Raza, 2016). However most corporations have management only, lacking leadership or only leadership with no management to conduct digital transformation (Raza, 2016). Executives who have been steeped in analogue leadership disciplines need to change in the digital world. The Manufacturing Leadership Council calls for Industrie 4.0 vision that leaders be technology-savvy, corporations are flatter and more collaborative structures, with empowered employees (Raza, 2016). Industrie 4.0 is further defined by global competition, information-driven factories, real-time information, great speed and agility and rapid adaptability (Raza, 2016).

LEADERSHIP IN THE DIGITAL AGE

The digital age is responsible for corporations needing to reshape and transform digital business (Khan, 2016; Nally, 2016). However, lack of digital leadership is the number one issue holding back digital business (Kotter, 1990). This likely requires finding differences in leadership, skills, and capabilities and to explore found models within today's corporate leadership model (Khan, 2016).

Leadership in the digital age is part of Leadership 4.0 (Nally, 2016). It is ideal for leading edge corporations and is theory based on continuous change models, with proven results replicated and shared among colleagues and publications (Kotter, 1995). This digital leadership framework is structured on a combination of motivational tools and leadership styles (Prince, Hamilton, & Tee, 2016). This is technopreneurial leadership, a leading edge competitive framework with transformational, transactional, and authentic leadership matrix (Hamilton & Lynch, 2012). It is through this 3D positioning horizons matrix that we find the trichotomous leadership styles with their digital age solutions (figure 2) (Hamilton, Tee & Prince, 2016). Finding a leadership position on this matrix affords the leader insight into their digital age structuration and demonstrates the steps required to attain digital age leadership.

DeSanctis and Poole (Desanctis & Scott, 1994) argue that technology and leadership participate in a recursive relationship with each affecting and transforming the other. (Avolio, Kahai & Dodge, 2001), and (Avolio *et al.*, 2014) also argue that leader and technology should co-evolve; with leadership being a corporate social structure created by technology.

Applying Adaptive Structuration Theory (AST) to this research is about applying the impact of Advanced Information Technology (AIT) interaction with leadership in relationship; and serves the customer driven digital ecosystem (Avolio *et al.*, 2014; Desanctis & Scott, 1994). Here, real-time data availability, digital services, and digital leadership serve the customer in a social construct (Avolio & Kahai, 2003b; Avolio, Kahai & Dodge, 2001).

Applying cutting edge AIT forces corporations to be receptive to new ideas and possibilities, providing a bottom up solution that any credible corporation could not ignore (Khan, 2016). AIT triggers an adaptive structurational process that over time changes rules and resources leading to a digital transformation (Desanctis & Scott, 1994). Consequently, a new leadership style emerges during the appropriation process which is arguably referred to as digital leadership (Desanctis & Scott, 1994).

Corporations lacking digital leadership are referred to as laggards (HBR Analytic Service, 2015). Laggards should be putting together a multidimensional framework to increase digital knowledge, competencies, and skills (HBR Analytic Service, 2015). Laggards fall behind digital leadership in three important key ways, lacking: digital first focus, connected platform of services, and digital coordination (Weill & Woerner, 2017).

Further research, 436 business leaders were interviewed by Harvard Business Review Analytic Services (HBR Analytic Service, 2015). A large gap was found between what's needed and the current state of corporations, with only 23% confident they have the necessary knowledge and skills to succeed in digital transformation. Furthermore, the lack of digital leadership is the number one issue holding corporations back with digital business (HBR Analytic Service, 2015). Digital transformation however, is more than simply modernising IT skills; this is improving communication and working with both formal and informal learning forums (HBR Analytic Service, 2015).

Digital transformation continually requires directive leadership; with the corporate leader aiming to improve performance with new digital technologies (Kotter, 1990, 1995). Digital leadership in this context has new rules of competition, to build cooperation between generations, close the gap between strategy and operations, attract the best talent, and solidify transformation in the corporation (Khan, 2016). Digital transformation occurs as members of corporate groups bring the structural potential of new technologies into interaction appropriating available structures during the course of group decision activities (Desanctis & Scott, 1994).

In this digital age, a combination of transformational, transactional, and authentic leadership is what engages the digital generation (Khan, 2016). Within these three leadership styles we establish a trichotomous model that provides the skills drivers for a future digital leadership model that identifies the shortcomings of existing leadership and to them provides a pathway to lead corporations into the future (Khan, 2016).

AUTHENTIC LEADERSHIP

Authentic leaders are committed to the need to belong; and inclusive belonging in the real world (Walumbwa *et al.*, 2008). The digital generation trust in these leaders because they are real, genuine, transparent, and balanced with good moral standing and self-awareness (Walumbwa *et al.*, 2008).

In simple terms, authentic leadership creates patterns of transparency, and openness building trust and healthy corporations (Walumbwa *et al.*, 2008). The authentic leader builds trust, meaning and healthier corporations through transparency (Walumbwa *et al.*, 2008). Transparent leaders who are authentic influence others to be authentic also, and role model high ethical standards (Walumbwa *et al.*, 2008).

Avolio and colleagues have studied Authentic Leaders and authenticity for some time, graduating from Charismatic Leadership, Transformational Leadership, E-Leadership and Authentic Leadership (Avolio *et al.*, 2014; Avolio, Kahai & Dodge, 2001; Walumbwa *et al.*, 2008). Their definition is four-fold; self- awareness, self-regulation, transparency, balanced decisions; however Avolio *et al.* (2014) "back to the future" premonition for leadership development has hardly considered the present need for digitalization and influence of the digital generation (Avolio *et al.*, 2014).

The digital generation want to follow authenticity, because it bellows 'care for others' (Khan, 2016). This is because the digital generation have developed a 'care for others' core value from having used social media for all their lives or the life of social media (Avolio *et al.*, 2014). Social media, like face to face socialising has a transformational effect on people (Avolio *et al.*, 2014). Leaders who hold social media in high esteem are few and far between (Khan, 2016). However, followers using social media, list the millions (Facebook, LinkedIn). Social media develops qualities unique to this type of communication alone. Social media and time for decisions is real time in flatter corporate structures (Walumbwa *et al.*, 2008). Whereas traditionally, managers managing other managers across multiple levels slows down decision making processes (Hamilton & Lynch, 2012).

The behavioural competencies a leader may require in the future of behaviourally astute generations, such as the digital generation needs simplification, rather than complex models (Avolio *et al.*, 2014). The authentic digital corporate leader is a self-aware and enduring organisation builder (Copeland, 2014) who balances scenario solutions against analysis (Rogers, 2016); and who builds transparent, genuine decision making solutions (Westerman *et al.*, 2011).

Over 90% of interviewed corporations lacked the necessary social media, mobile, internal social networks, performance analysis skills (Spitzer *et al.*, 2013). Further research revealed that 87% of corporations feel competitive opportunities are available through digital transformation; but corporations are not investing in digital skills development with only 46% investing in digital skills development (Spitzer *et al.*, 2013).

TRANSFORMATIONAL AND TRANSACTIONAL LEADERSHIP

Transformational leadership was first explored by (Burns, 1978) and developed further by (Bass, 1985) and is a transformational paradigm. Four distinct features that transformational leaders have are idealised influence, inspirational motivation, intellectual stimulation and individualised consideration (Sarros & Santora, 2001). Transformational leadership creates relationships that raise motivation and morality in both leader and their follower (Northouse, 2013); while transactional leaders do not individualise the needs of followers nor care about their development (Northouse, 2013).

Transactional leadership traditionally focuses on the reward exchanges that occur between leaders and their followers and has two distinct features; contingent reward, and management by exception (Northouse, 2013). Contingent reward leadership appeals to the needs and wants of individuals, achieves results, and rewards people tangibly for their efforts (Sarros & Santora, 2001). Management by exception leaders have implicit trust in their workers to finish to a satisfactory standard, avoid rocking the boat, and the business exists day to day with little sense of new horizons (Sarros & Santora, 2001).

The manifestation of transformational leadership has taken new forms because of digitalization; and characteristics of digital transformational leadership help empower a leader's motivation through technology, and clarifys the higher purpose of work to others (Khan, 2016). The digital transactional leader displays a behaviourally-focused and human capital motivation perspective (Xavier Lhuer, Tunde Olanrewaju, 2015). A study of 181 executives from Australian top 500 corporations, suggest there remains ambiguity about the leadership role of business executives (Sarros & Santora, 2001). It was found that these executives feel comfortable coaching their people to results but see the need for direction (Sarros & Santora, 2001).

Balancing opposite ends of a continuum transformational transactional leadership presents ongoing challenges for these executives (Sarros & Santora, 2001). While leaders who care for and nurture their workers set high standards for their corporation to enhance interpersonal skills of compassion, consistently high ethical behaviour, and communication (Sarros & Santora, 2001). Consequently leaders need to focus on the meaning behind the message, not simply the message content (Sarros & Santora, 2001).

Sarros and Santora (2001) argue that leaders are being driven into unfamiliar territory with change the only constant; and how the change is handled has direct bearing on business success (Sarros & Santora, 2001). The successful business has a successful leader, the successful leader deals with the future vision and transformation (Sarros & Santora, 2001). While transactional leadership is more focused on achieving results through corporate processes such as policies, procedures, and rewards; transformational leadership is more focused on the needs of individuals (Sarros & Santora, 2001)

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CONCLUSION

Technology today enables a new economy in Corporate Leadership for e-business, e-commerce, m-commerce, technopreneurialism, ambiguity, disorder and the ability to adapt to rapid business change (Dasgupta, 2011). Building successful corporations today requires rapid business change and transformation (Khan, 2016). This rapid change is at the heart of transformational states of mind (Avolio & Kahai, 2003a). The Digital Corporate Leader not only manages these transformational states of mind, the Digital Corporate Leader identifies inter-generational cooperation; and forms visions of potentiality, closing the gap with reality (Avolio & Kahai, 2003a).

The digital corporate leader needs a new attitude; capability and knowledge (competency set) (Spencer & Spencer, 1993). These leaders need to make a difference; to the corporate, business, stakeholders, and society (Dasgupta, 2011). However, the communication and technology revolution has shifted to real-time competitive knowledge-based and innovation economies (Dasgupta, 2011); consequently this rapid technology growth in corporations and extended global reach is normal today; and gives rise to the digital corporate leader.

Today's digital corporate leader delivers a competitiveness position and this often delivers disruptive change and digital transformation (Avolio *et al.*, 2014; Kotter, 1995. The rapid technology growth increasingly flattens the corporate (Kotter, 1995; Walumbwa *et al.*, 2008). In this context digital corporate leaders have new rules of competition, to build cooperation between generations, close the gap between strategy and operations, solidify change in the corporate, and attract the best talent (Northouse, 2013).

Today researchers typically view Corporate Leaders as managing complex, digitally changing corporates (Avolio *et al.*, 2014). The three leadership styles we covered above: transactional values-based; transformation business-reinvention; and authentic self-aware enduring corporate builds, show preference (Khan, 2016). These leadership styles each make different contributions and they do not have to be mutually exclusive. Hence, future leading edge Digital Corporate Leaders can develop their strategies separately (as pure transaction, pure transformation or pure authentic) or by incorporating aspects of all three leadership styles together in a digital matrix model (Khan, 2016). To help understand the complexities facing today's Digital Corporate Leaders and their ongoing corporate digitalizing considerations this research develops a theoretical model to look at these three leadership theories and apply them to a Digital Corporate Leadership model.

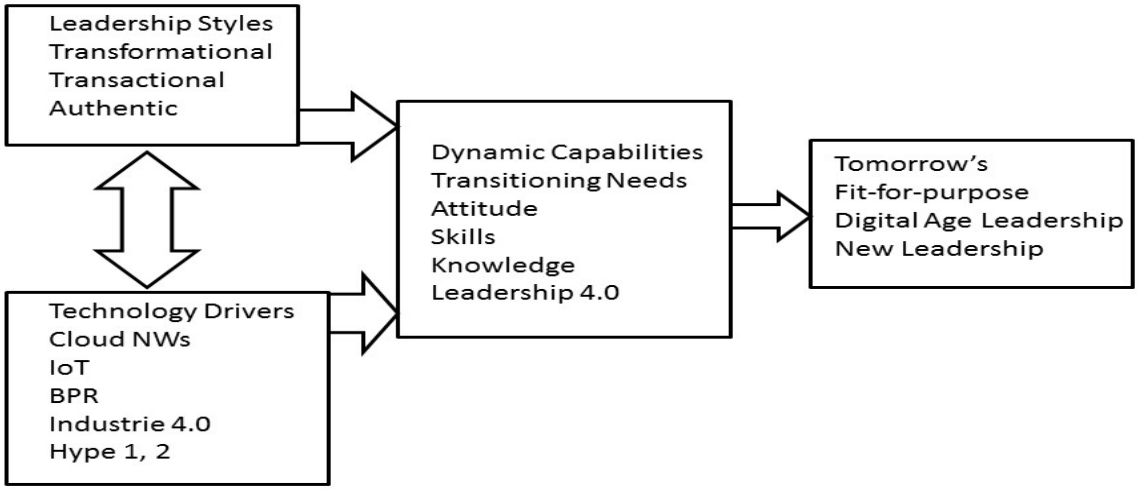

Figure 1: Digital Age Leadership Transitioning Model

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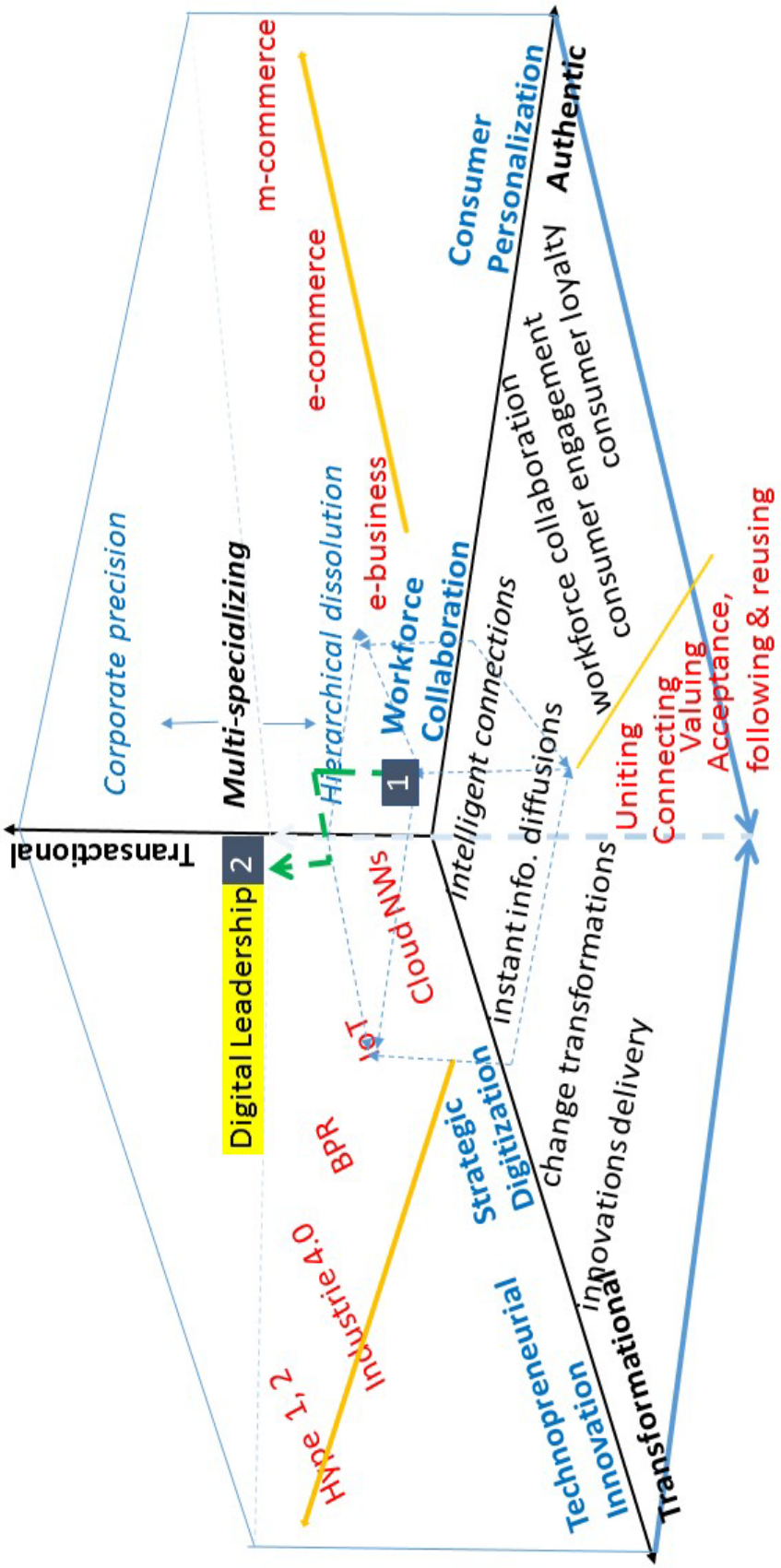

Figure 2: Corporate Leader digital age 3D positioning horizons matrix